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Oxytetracycline* and Its Use as a Meat Preservative in Underdeveloped Countries

BY

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SUMMARY.—Fifteen cattle and 13 sheep were treated with Biostat containing 20 per cent. oxytetracycline by intraperitoneal injections, spray, and dipping methods, and tested after 24, 48, and 72 hours respectively under varying and severe tropical or semi-tropical conditions.

It was found that Biostat improves the keeping quality of fresh meat and beef in particular, extending its fitness for human consumption from 48 to 72 hours, provided the initial handling of the slaughter animals conforms with the demands of meat hygiene.

The intraperitoneal method, although the most effective in controlling deep spoilage, would be impracticable in larger abattoirs as the immobilisation of cattle requires time not easily afforded in commercial slaughter.

The spray method with Biostat, in its overall effect equal to the intraperitoneal, and even more efficient in the inhibition of superficial growth of bacteria is suggested as a routine measure for the preservation of fresh meat. Particularly so since it was shown in these trials that in tropical and semi-tropical conditions surface spoilage must be checked.

The dipping of carcases is suitable for small stock only and even then is complicated in its application and unsuitable for commercial slaughter.

The proper treatment of slaughter animals and the hygienic handling of carcases in the initial stages has also a favourable influence upon the keeping quality of treated meat.

The development of potentially dangerous Clostridia and coagulase-positive staphylococci is effectively controlled.

The colour and odour of the treated meat is improved.

The destruction of Biostat by cooking has been confirmed.

Biostat, as a preservative for fresh meat, might be considered in tropical and semi-tropical underdeveloped countries, where sufficient cold storage facilities are not available, provided the use of this and other antibiotics suitable for the preservation of food is controlled by law.

THROUGHOUT the ages, man has devised various methods for prolonging the storage life of perishable foods and, whilst many of these methods have since been rejected, others are still in use. The majority were based upon drying, salting, canning, cooking, fermenting, or freezing. As a result of extensive research, observation, and practical experience, most foods can to-day be preserved for an indefinite period without affecting either their quality or palatability. The problem of preserving meat, poultry, and fish, however, has not been entirely solved. Good though the modern methods are, they not only affect to a certain extent flavour and colour, but also generally demand expensive installations and maintenance. It has, therefore, not been surprising that the food producer should turn his attention towards the antibiotics, once their potent bacteriostatic and bactericidal properties had been proved in human medicine. The lead in this search for a new and more practical preservative was taken by the U.S.A., where, in 1955, an antibiotic for the conservation of fresh poultry was introduced into the Food and Drugs Act. Canada followed this example, whilst many other countries are at present considering its advantages.

Although this idea is now steadily gaining ground all over the world, little use is being made of these new drugs as a preservative for the staple food of millions, that is to say, fresh red meat (Taylor, 1956). Perhaps it is feared that treated flesh eaten in quantity may have ill effects upon health or that unscrupulous butchers may try to cover insanitary or unhygienic practices as they have done many times in the past

* Biostat; Chas. Pfizer, Cyanamid of Great Britain, Limited.

with other preservatives. Whatever the reason, the fact remains that the absence of proper methods of preservation in underdeveloped countries in particular not only affects national economy but constitutes a threat to health. In lands where cold storage facilities are few, a method must be found to prolong the keeping quality of this valuable food.

Experimental

Methods and Material

The purpose of this research was to study the effectiveness of Biostat containing 20 per cent. of oxytetracycline in inhibiting spoilage of fresh red meat produced in such conditions as encountered in hot and underdeveloped countries.

The experiments were carried out in the Athi River meat works and the Mombasa abattoir of the Kenya Meat Commission. The climate of Athi River, 4,940 feet above sea level, is hot but dry, whilst that of Mombasa, situated on the shores of the Indian Ocean, is typically tropical. The investigations took place at the onset of the long rains, the most unfavourable season for the keeping of any fresh foods.

During the production of meat there are 2 moments suitable for the application of antibiotics. This can be done either while the animal is resting in the lairages awaiting slaughter, or *post mortem*, on the killing and dressing floor. Both possibilities were taken into consideration. An intraperitoneal injection (15 grammes Biostat per 1,000 lb. live-weight) into the left paralumbar fossa was given 2 hours prior to slaughter. At *post mortem*, use was made of the dip (5 grammes Biostat in 10 litres water) in the case of sheep carcases only, otherwise the spray method (5 grammes Biostat in 10 litres water) was applied. This was carried out by means of an ordinary hand stirrup pump standing in the vessel containing the aqueous solution of Biostat.

Fifteen cattle of the Zebu type and 13 native sheep served as experimental animals. Slaughter and storage by up-to-date methods was restricted to 3 beasts only, to provide a comparison between proper conditions and those normally encountered in underdeveloped countries. Another batch of animals, consisting of 3 cattle and 3 sheep was slaughtered in the Athi River meat works and then sent to an African butcher's shop. This shop, although primitive by present standards of meat hygiene, does indeed represent progress when compared with the usual " counter " of twigs and banana leaves in the shade of a tree. The object of slaughter in a modern plant with the subsequent sale of the meat in a primitive shop, both in Athi River and Mombasa, was to show whether the correct handling of meat in the initial stages could have favourable influence upon the keeping quality of meat treated with Biostat (Jensen, 1954). The remaining experimental animals in Athi River were either slaughtered in a local African abattoir of the slightly more advanced type or under the thorn tree, the selected place for " bush slaughter." Whilst the simplest abattoir offers at least some possibility of hygiene, slaughter in the open is subject to continuous contamination by earth, faeces, and flies by the thousand. The meat in the African butcher's shop used for this investigation was hung in 2 cupboards similar in construction to wardrobes but with doors made from wire mosquito netting. There was no form of ventilation and the carcases touched one another. The shed used for hanging meat derived from the " bush " slaughter (carried out for this purpose under a tree in the Athi River factory's courtyard) had a wooden frame-work covered by corrugated asbestos sheets and walls of expanded wire. The wire allowed the passage of plenty of air as the shed faces the prevailing wind and was thus one of the coolest buildings in the factory compound. Its original purpose was to serve for drying gullets and bladders.

The Mombasa meat works are built on a rock. The hanging hall, situated on the upper floor of the building, faces the open sea and receives all prevailing winds on 3 sides. During calm weather, the air is kept circulating by a number of well-placed electric fans. There is no cold store attached to the abattoir since the Arab population objects to the consumption of chilled meat. Carcases are normally hung for about 18 hours in the abattoir before removal by the meat trade. The experimental animals were divided into 2 batches. The first remained in the hanging hall, while the second was removed to a typical Eastern meat stall in the Mombasa African market. The stone counter of this stall, laden as it is with meat and viscera, is exposed to dust, flies, and the fingering of prospective customers.

All experimental carcases were held for 72 hours. Every 24 hours samples were taken for laboratory tests and at the same time the carcases and joints were examined by the usual methods employed in meat inspection.

The experimental animals were divided into 4 main groups. The first, consisting of 6 cattle, was slaughtered in the Athi River plant where the only deviation from routine factory procedure was the *ante-mortem* intraperitoneal injection into the paralumbar fossa of 2 beasts 2 hours prior to stunning. The dressed carcases were split, and 2 of these were sprayed with approximately 2 pints of a watery solution of Biostat. Two carcases were retained untreated as controls. The group was then sub-divided into 2 batches of 3 carcases each; one lot being placed in the cold store (average temperature 40° F.), while the other carcases were taken 3 hours after slaughter to the African butcher's shop. A push-cart, made from the rear axle of an old car with a superimposed body-work of old boards and tin sheets, was used for transport. This box body afforded little or no protection against dust or dirt. Normal sale of the meat took place during the 3 days that followed.

A further group of 6 cattle was similarly subdivided into 2 batches. The first was killed and dressed in the local African slaughter-house; the second under the tree in the factory compound. Each batch contained treated, as well as untreated, carcases and sides such as described in the first group. The carcases were mercilessly piled on top of each other in the slaughter-house on a cement slab and under the tree on a " ground sheet " made from the inside of one of the flayed hides. The African attendants were specially encouraged to perform the task as in their

own reserve. The carcases from the slaughter-house were conveyed in the push-cart to the African butcher's shop and those from under the tree were carried to the shed already described. No protective clothing was worn by those engaged in this task. Unfortunately, the meat could not be exposed on a native stall made from twigs and banana leaves as, unguarded, insufficient would have remained to carry out even the first 24 hours sampling.

The third group, composed of 9 sheep, was subdivided into 3 batches. The first lot, consisting of 3 sheep, was slaughtered in the Athi River meat works. The previous procedure was followed save in the case of 1 carcase, which was dipped in 20 gallons of a watery solution of Biostat for 15 seconds (45 grammes dissolved in 20 gallons water). After hanging for 3 hours, the carcases were taken by the push-cart to the African butcher's shop. The second batch was

TRIAL 1.

DEEP TISSUE COUNT PER GRAMME

	Code	Age hour	Total aerobic	Streptococci	Staphylococci	Clostridia	*p*H	Organoleptic
Control	A1	24	9,000	< 1,000	< 1,000	< 1,000	6·2	Normal
	A2	48	7,000	< 1,000	< 1,000	< 1,000	6·0	,,
	A3	72	47,000	< 1,000	3,000	< 1,000	6·1	,,
Intraperitoneal	D1	24	10,000	< 1,000	< 1,000	< 1,000	5·9	,,
	D2	48	430,000	< 1,000	< 1,000	< 1,000	5·8	,,
	D3	72	1,000	< 1,000	< 1,000	< 1,000	5·9	,,
Sprayed	B1	24	6,000	< 1,000	< 1,000	< 1,000	5·9	,,
	B2	48	70,000	< 1,000	< 1,000	< 1,000	5·8	,,
	B3	72	10,000	< 1,000	< 1,000	< 1,000	5·9	,,
Control Side of B	C1	24	2,000	< 1,000	< 1,000	< 1,000	5·9	,,
	C2	48	13,000	< 1,000	< 1,000	< 1,000	5·8	,,
	C3	72	8,000	< 1,000	< 1,000	< 1,000	5·9	,,

Temperature (F) : 24 hour — 48°, 48 hour — 43°, 72 hour — 41°.
Humidity : 24 hour — 86 per cent, 48 hour — 88 per cent., 71 hour — 84 per cent.

SWABS — TOTAL AEROBIC COUNT PER SQUARE FOOT

	24 hour	48 hour	72 hour
Control A	1,750,000	950,000	450,000,000
Intraperitoneal D	290,000	60,000	500,000
Sprayed B	9,500	19,500	45,500
Control side of B — C	40,000	50,000	1,150,000

TRIAL 2

DEEP TISSUE COUNT PER GRAMME

	Code	Age hour	Total aerobic	Streptococci	Staphylococci	Clostridia	*p*H	Organoleptic
Control	E1	24	230,000	< 1,000	< 1,000	< 1,000	5·5	Normal
	E2	48	65,000	5,000	< 1,000	< 1,000	5·7	Slight odour
	E3	72	260,000	85,000	< 1,000	< 1,000	6·1	Putrid smell
Intraperitoneal	H1	24	230,000	< 1,000	< 1,000	< 1,000	5·6	Normal
	H2	48	190,000	1,000	< 1,000	< 1,000	5·8	Normal
	H3	72	5,000	< 1,000	< 1,000	< 1,000	5·9	Slight odour
Sprayed	F1	24	36,000	< 1,000	< 1,000	< 1,000	5·6	Normal
	F2	48	1,600,000	14,000	< 1,000	< 1,000	5·8	Normal
	F3	72	1,500,000	22,000	< 1,000	< 1,000	5·9	Slight odour
Control Side of F	G1	24	80,000	< 1,000	< 1,000	< 1,000	5·6	Normal
	G2	48	600,000	< 1,000	< 1,000	< 1,000	5·8	Slight odour
	G3	72	500,000	2,000	< 1,000	< 1,000	6·0	Putrid smell

Temperature : 24 hour — 72°, 48 hour — 71°, 72 hour — 68°.
Humidity : 24 hour — 65 per cent, 48 hour — 73 per cent., 72 hour — 83 per cent.

SWABS — TOTAL AEROBIC COUNT PER SQUARE FOOT

	24 hour	48 hour	72 hour
Control E	6,500,000	28,000,000	4,000,000,000
Intraperitoneal H	7,000,000	17,500,000	210,000,000
Sprayed F	4,000,000	46,500,000	22,000,000
Control side of F — G	16,500,000	125,000,000	390,000,000

killed in the local African slaughter-house and these too were sent by push-cart to the native butcher. The third and final lot was slaughtered under the tree and carried to the shed for hanging. It should be pointed out that the sheep carcases were not actually piled one on top of the other but were strung to iron bars or to the branches of the thorn tree.

The last group, consisting of 3 cattle and 4 sheep, was killed in the Mombasa abattoir. This group was sub-divided into 2 batches. The 1 remaining in the hanging hall of the abattoir consisted of a control, a sprayed, and an intraperitoneally injected side. There were also 4 sheep sides, 1 of which was used as a control, 1 dipped, another sprayed, and the last, intraperitoneally treated. A similar batch was sent after 18 hours hanging in the abattoir to a meat stall in the African market. The meat was transported from the abattoir by a motor vehicle equipped with a barrel-shaped wooden container for the conveyance of meat in which the quarters lay in a heap. On reaching the market, these were transferred to a cupboard serving as a store at the back of the counter, where the only ventilation was a mosquito wire covered door, which admitted dust from the market. The quarters had to be hung on top of one another as space was so limited. Joints were removed from this cupboard and displayed on hooks above the stone counter as required. The meat which is sold last or that which remains unsold may thus be kept in these conditions for anything up to 12 hours. In this particular instance, the meat remained in the cupboard from 5 a.m. to 6 p.m. As it could not be left overnight in the open market, it was returned to the abattoir, where it was stored in conditions similar to those encountered in the cupboard of the meat stall. The temperature taken at 9 a.m. on the first day of the experiment in Mombasa in front of the meat stall was 91° F. with a humidity of 72 per cent. At 2 p.m. the temperature reached 98° F. with 100 per cent. relative humidity.

The second lot of sides, retained in the hanging hall of the Mombasa abattoir, were spared the unhygienic treatment undergone by those delivered to the meat stall. The temperature of the hanging hall did not at any time exceed 85° F., but during the first 24 hours, the relative humidity also reached the 100 per cent. mark.

Surface Contamination

Measured, intact surfaces of carcase sides were twice swabbed with calcium alginate wool swabs. These were dissolved in ¼ strength Ringer's solution containing 1 per cent. sodium hexa-meta-phosphate and the volume adjusted so that 1/50 ml. was equivalent to 10^{-4} square feet. Serial 1 in 10 dilutions were made in ¼-strength Ringer's solution using a standard technique and 1 drop of each dilution was added to a nutrient agar plate using " 50-drop " pipettes. The plates were incubated at 30° C. for 2 days.

Deep Contamination

To excise deep tissues, the surface of the muscles was cleaned with alcohol and a wedge-shaped section was then removed with a sterile knife. Out of this piece, 10 grammes were aseptically removed and transferred into an Ato-mix container. The volume was then made up to 200 ml. with sterile distilled water. The sample was macerated for 2 minutes at ½ speed and 1 minute at full speed. Serial 1 in 10 dilutions were then prepared in ¼-strength Ringer's solution using a standard technique.

Using " 50-drop " pipettes, a drop of each dilution was added to nutritive media in Petri dishes. Thus 1 drop from the container was equivalent to 10^{-3}

TRIAL 3

DEEP TISSUE COUNT PER GRAMME

	Code	Age hour	Total aerobic	Streptococci	Staphylococci	Clostridia	*p*H	Organoleptic
Control	N1	24	200,000	7,000	2,000	< 1,000	5·6	Slight odour
	N2	48	19,000,000	1,500,000	200,000	< 1,000	5·6	Very strong odour
	N3	72	13,000,000	1,800,000	31,000	< 1,000	5·6	Black putrid
Intraperitoneal	Q1	24	320,000	< 1,000	< 1,000	< 1,000	5·7	Slight odour
	Q2	48	16,000	1,000	1,000	< 1,000	5·7	Strong odour
	Q3	72	17,000	< 1,000	< 1,000	< 1,000	5·8	Very strong odour
Sprayed	O1	24	2,000	< 1,000	< 1,000	< 1,000	5·7	Normal
	O2	48	800,000	350,000	3,000	< 1,000	5·7	Slight odour
	O3	72	2,700,000	100,000	< 1,000	< 1,000	5·7	Slight odour
Control side of O	P1	24	1,000	< 1,000	< 1,000	< 1,000	5·7	Slight odour
	P2	48	250,000	60,000	1,000	< 1,000	5·8	Very strong odour
	P3	72	1,000,000	60,000	< 1,000	<1,000	5·6	Very strong odour

Temperature : 24 hour — 72°, 48 hours — 71°, 72 hours — 70°.
Humidity : 24 hours — 69 per cent., 48 hours — 78 per cent., 72 hours — 77 per cent.

SWABS — TOTAL AEROBIC COUNT PER SQUARE FOOT

	24 hours	48 hours	72 hours
Control N	60,000,000	400,000,000,000	1,000,000,000
Intraperitoneal Q	8,000,000	130,000,000	220,000,000
Sprayed O	300,000	310,000	160,000
Control side of O — P	140,000,000	3,500,000,000	1,500,000,000

grammes and subsequent dilutions gave 10^{-4}, 10^{-5} grammes, etc.

Nutrient agar plates were incubated at 30° C. for 2 days; Sabouraud's maltose agar at 25° C. for 3 days; Ella Barnes (1956) streptococcal media at 37° C. for 24 hours.; and staphylococcal medium of Zebovitz *et al.* (14) at 37° C. for 24 hours. In addition, a shake tube of 10 ml. of oxoidiron-sulphite agar was inoculated to isolate Clostridia and this was then incubated at 37° C. for 3 days. In the early stages of the trials tomato juice agar was also inoculated and incubated at 37° C. for 2 days to isolate Lactobacilli. All except the selective media for Streptococci and Staphylococci were dehydrated oxoid media.

For the assessment of the *p*H of the carcases, muscles were macerated and the reading was taken on a Marconi meter.

The lead acetate test of Schönberg for " stinky acid fermentation " was carried out on all carcases which, after 48 hours showed any acid *p*H reading, combined with an odour and with a change of colour of the freshly exposed muscle surfaces.

Results

Test 1—Cattle slaughtered at the K.M.C. works and stored at approximately 40° F.

The *p*H was normal except in the control which showed peritonitis and pleurisy on autopsy. The surface count proved to be the lowest in the side which was sprayed with Biostat. The deep tissue count, on the other hand, was best in the carcase which received an intraperitoneal injection. Although there was no appreciable difference in the deep tissue count between the control and the treated carcases, the surface counts in the sprayed side and the one intraperitoneally treated were consistently many times lower than the controls.

Test 2—Cattle slaughtered at the K.M.C. works and transferred to the African butcher's shop

The development of micro-organisms was similar to that described in the first test save that Lactobacilli became more numerous towards the third day. This acid fermentation was caused by the insufficient ventilation of the African butcher's shop. A substantial increase was also noted in the number of Streptococci (mainly faecalis) presumably due to unhygienic handling. It can also be attributed to the push-cart which was used in addition for the transport of hides. The surface count after 72 hours was again lowest in the side which had been sprayed, the deep tissue count in the carcase which had been treated intraperitoneally. After 72 hours the control developed a strong odour, whilst the sprayed and intraperitoneally injected carcase evinced a very slight one only.

Test 3—Cattle slaughtered in the local African abattoir and transferred to the native butcher's shop

The improper initial treatment of carcases during slaughter and dressing was apparent in this test performed in the local African abattoir. The overall contamination was strongly emphasised, with faecal Streptococci in the lead. The organisms recovered from the surface of the sprayed side were mainly yeast, Biostat having inhibited mostly the bacterial flora encountered on the control sides. Deep tissue growth was again effectively checked by intraperitoneal injection with, in addition, a reduction in surface spoilage. Surface contamination in the sprayed side was quite substantially reduced and whilst the control carcase became putrid after 72 hours that which had been sprayed had developed a faint odour only. The carcase treated by intraperitoneal injection was disappointing, as it became decomposed after 48 hours, a slight smell already being apparent after 24 hours of hanging. It is likely that this early deterioration was due to the fact that the carcase lay at the bottom of a heap of sides awaiting transport to the African butcher's shop, so that the essential initial cooling after slaughter did not take place.

Test 4—Cattle slaughtered under a tree and hung in K.M.C. shed

This test, showing an extremely low deep tissue count, was carried out in conditions as primitive and unhygienic as are only to be found in the native reserve. If the deep count was nevertheless low, it can be attributed only to the fact that putrefaction spreads mainly from the surface (Lepovetsky *et al.*, 1953). In this case, because of the heaping up of carcases after slaughter, autolytic changes occurred, developing a typical " stinky acid fermentation " towards the third day in both treated and untreated meat. Although the carcases were dressed on the ground, surface growth was negligible even in the control, as the sides were exposed to a continuous stream of fresh and drying air in the store. However, even here the sprayed carcase showed the least surface counts on the second and third day.

Test 5—Sheep slaughtered in the K.M.C. works and transferred to the African butcher's shop

The overall contamination both in deep and surface tissue counts was considerably higher in the control than in the treated carcases. By the third day the control had developed a clostridial growth with typical signs of putrefaction. A fairly high *Streptococcus lactis* count in all sides and a coagulase positive staphylococcal growth in the control and sprayed carcase were also noted. The contaminating organisms of the control were mainly composed of *Proteus vulgaris*. A small number of Proteus was also apparent on the surface of the sprayed and dipped carcases. As mutton is naturally less resistant to decomposition it was not surprising to find that an unpleasant odour had developed after 24 hours and typical Clostridial putrefaction in all control sides after the third day of inspection. The intraperitoneally injected carcase was malodorous after 48 hours and at the time of the third testing, putrefactive changes were obvious but no Clostridia could be detected. In the sprayed side, surface contamination was again comparatively low.

Test 6—Sheep slaughtered in the local African abattoir and transferred to the native butcher's shop

The control developed a very strong odour after 48 hours and heavy contamination of the deep tissue samples with *Proteus vulgaris* and Clostridia was

noted. The intraperitoneally injected carcase also produced large numbers of *Proteus vulgaris* after 72 hours both from the surface and from the deep tissue cultures. The sprayed and dipped sides, on the other hand, produced only a few *Proteus vulgaris* organisms, when tested after 72 hours. A fairly high streptococcal content, mostly of the Type D, was noted in the intraperitoneally treated carcase and in the dipped side. After 48 hours the carcase, which had been injected intraperitoneally, showed signs of decomposition but the sprayed and dipped sides remained in perfect condition until the third day.

TRIAL 4

DEEP TISSUE COUNT PER GRAMME

	Code	Age hour	Total aerobic	Streptococci	Staphylococci	Clostridia	*p*H	Organoleptic
Control	J1	24	< 1,000	< 1,000	< 1,000	< 1,000	5·5	Slight odour
	J2	48	< 1,000	< 1,000	< 1,000	< 1,000	5·7	Slight odour
	J3	72	< 1,000	< 1,000	< 1,000	< 1,000	5·5	Strong odour
Intraperitoneal	M1	24	< 1,000	< 1,000	< 1,000	< 1,000	5·5	Slight odour
	M2	48	< 1,000	< 1,000	< 1,000	< 1,000	5·6	Slight odour
	M3	72	4,000	< 1,000	< 1,000	< 1,000	5·6	Strong odour
Sprayed	K1	24	< 1,000	< 1,000	< 1,000	< 1,000	5·7	Normal
	K2	48	9,000	< 1,000	< 1,000	< 1,000	5·7	Normal
	K3	72	1,000	< 1,000	< 1,000	< 1,000	5·6	Slight odour
Control side of K	L1	24	< 1,000	< 1,000	< 1,000	< 1,000	5·7	Normal
	L2	48	9,000	< 1,000	< 1,000	< 1,000	5·8	Slight odour
	L3	72	< 1,000	< 1,000	< 1,000	< 1,000	5·6	Very strong odour

Temperature : 24 hours — 69°, 48 hours — 66°, 72 hours — 68°
Humidity : 24 hours — 72 per cent., 48 hours — 85 per cent., 72 hours — 81 per cent.

SWABS — TOTAL AEROBIC COUNT PER SQUARE FOOT

	24 hours	48 hours	72 hours
Control J	10,000	170,000	160,000
Intraperitoneal M	1,000	90,000	140,000
Sprayed K	40,000	80,000	10,000
Control side of K — L	40,000	240,000	50,000

TRIAL 5

DEEP TISSUE COUNT PER GRAMME

	Code	Age hour	Total aerobic	Streptococci	Staphylococci	Clostridia	*p*H	Organoleptic
*Control	V1	24	200,000	15,000	23,000	< 1,000	6·0	Normal
	V2	48	16,000,000	57,000	16,000	< 1,000	5·8	Moderate to strong odour
	V3	72	24,000,000	330,000	3,000	2,000,000	6·1	Green putrid
Intraperitoneal	W1	24	90,000	5,000	< 1,000	< 1,000	6·5	Normal
	W2	48	180,000	120,000	1,000	< 1,000	5·8	Moderate odour
	W3	72	20,000	1,000	< 1,000	< 1,000	5·8	Strong odour
Sprayed	X1	24	14,000	2,000	< 1,000	< 1,000	5·9	Normal
	X2	48	2,000,000	9,000	1,000	< 1,000	5·8	Normal
	X3	72	5,000,000	3,400,000	32,000	< 1,000	5·7	Moderate odour
Dipped	Y1	24	20,000	7,000	< 1,000	< 1,000	6·0	Normal
	Y2	48	33,000	< 1,000	< 1,000	< 1,000	5·8	Norma
	Y3	72	16,000	6,000	< 1,000	< 1,000	5·7	Strong odour

Temperature : 24 hours — 75°, 48 hours — 71°, 72 hours — 72°
Humidity : 24 hours — 66 per cent., 48 hours — 63 per cent., 72 hours — 69 per cent.

SWABS — TOTAL AEROBIC COUNT PER SQUARE FOOT

	24 hours	48 hours	72 hours
†Control V	1,000,000,000	90,000,000,000	15,000,000,000
Intraperitoneal W	310,000,000	400,000,000	150,000,000
Sprayed X	4,000,000	280,000,000	430,000,000
Dipped Y	16,000,000	2,100,000,000	560,000,000

*The control samples were the pooled tissues from the untreated sides of X and Y
†The control swabs were pooled swabs from the untreated sides of X and Y.

Test 7—Sheep slaughtered under a iree and hung in the shed

The carcases on the whole showed a scanty growth of Streptococci, Staphylococci, and yeasts. The deep tissue contamination, however, of the control sides was heavy and some Clostridia were present, causing typical gaseous putrefaction after 48 hours. In the dipped sides, the prevalent organism was *Proteus vulgaris*. Because of the natural ventilation of the store, the sides were quite dry on the surface, thus

TRIAL 6

DEEP TISSUE COUNT PER GRAMME

	Code	Age hour	Total aerobic	Streptococci	Staphylococci	Clostridia	*p*H	Organoleptic
*Control	AA1	24	3,800,000	280,000	120,000	< 1,000	5·8	Normal
	AA2	48	110,000	40,000	14,000	< 1,000	6·5	Strong odour
	AA3	72	800,000	30,000	< 1,000	400,000	6·1	Putrid green
Intraperitoneal	BA1	24	50,000	< 1,000	1,000	< 1,000	5·8	Normal
	BA2	48	600,000	10,000	1,000	< 1,000	5·8	Moderate odour
	BA3	72	400,000	< 1,000	< 1,000	< 1,000	5·7	Moderate odour
Sprayed	CA1	24	5,000	1,000	< 1,000	< 1,000	5·9	Normal
	CA2	48	4,000	< 1,000	< 1,000	< 1,000	5·7	Normal
	CA3	72	170,000	33,000	< 1,000	< 1,000	5·9	Odour
Dipped	DA1	24	40,000	9,000	< 1,000	< 1,000	5·9	Normal
	DA2	48	700,000	36,000	< 1,000	< 1,000	5·8	Normal
	DA3	72	200,000	22,000	< 1,000	< 1,000	5·7	Strong odour

Temperature : 24 hours — 75°, 48 hours — 71°, 72 hours — 72°.
Humidity : 24 hours — 66 per cent., 48 hours — 73 per cent., 72 hours — 69 per cent.

SWABS — TOTAL AEROBIC COUNT PER SQUARE FOOT

	24 hours	48 hours	72 hours
†Control AA	600,000,000	21,000,000,000	10,000,000,000
Intraperitoneal BA	17,000,000	64,000,000	900,000,000
Sprayed CA	300,000	18,000,000	630,000,000
Dipped DA	7,000,000	230,000,000	770,000,000

*The control samples were the pooled tissues from the untreated sides of CA and DA.
†The control swabs were pooled swabs from the untreated sides of CA and DA.

TRIAL 7

DEEP TISSUE COUNT PER GRAMME

	Code	Age hour	Total Aerobic	Streptococci	Staphylococci	Clostridia	*p*H	Organoleptic
*Control	R1	24	1,000	< 1,000	< 1,000	< 1,000	5·9	Normal
	R2	48	2,000	< 1,000	< 1,000	< 1,000	6·0	Strong odour
	R3	72	800,000	2,000	< 1,000	20,000	6·0	Putrid green
Intraperitoneal	S1	24	1,000	< 1,000	< 1,000	< 1,000	6·0	Normal
	S2	48	< 1,000	< 1,000	< 1,000	< 1,000	5·7	Normal
	S3	72	60,000	< 1,000	< 1,000	< 1,000	6·1	Moderate odour
Sprayed	T1	24	< 1,000	< 1,000	< 1,000	< 1,000	6·0	Normal
	T2	48	< 1,000	< 1,000	< 1,000	< 1,000	5·7	Normal
	T3	72	15,000	1,000	< 1,000	< 1,000	5·8	Slight odour
Dipped	U1	24	< 1,000	< 1,000	< 1,000	< 1,000	5·9	Normal
	U2	48	< 1,000	< 1,000	< 1,000	< 1,000	5·9	Normal
	U3	72	60,000	< 1,000	< 1,000	< 1,000	5·6	Slight odour

Temperature : 24 hours — 68°, 48 hours — 69°, 72 hours — 71°.
Humidity : 24 hours — 81 per cent., 48 hours — 78 per cent., 72 hours — 69 per cent.

SWABS — TOTAL AEROBIC COUNT PER SQUARE FOOT.

	24 hours	48 hours	72 hours
†Control R	600,000	290,000	100,000
Intraperitoneal S	2,500,000	80,000	100,000
Sprayed T	1,000,000	700,000	40,000
Dipped U	150,000	30,000	2,500,000

*The control samples were the pooled tissues from the untreated sides of T and U.
†The control swabs were pooled swabs from the untreated sides of T and U.

inhibiting the growth of organisms. All carcases treated with Biostat remained fresh until the second day. The sprayed side preserved itself best and retained, despite a faint odour, a good appearance.

Test 8—Cattle and sheep slaughtered in the K.M.C. abattoir, Mombasa, and transferred to the African market

Although the atmospheric conditions were most unfavourable to the preservation of meat, neither sprayed nor intraperitoneally treated beef sides produced a smell after 48 hours hanging, whereas the control carcase showed clostridial putrefaction. After the third day the treated carcases began to smell although Clostridia were not present. The surface count of the sprayed side and the deep tissue count of the intraperitoneally treated carcase showed, even after 72 hours, only a comparatively small number of organisms.

Both control and treated sheep sides were unfit for human consumption on the second day of testing. However, when compared with the controls, the treated sides showed a lower bacterial count and appearance and odour had not yet become typical of decomposition. All carcases were visibly covered with yeasts (of the genus Trichosporon) after 24 hours. Clostridial putrefaction began in the control prior to the second testing after 48 hours, whereas in the sprayed and dipped sides, no such decomposition was noted even after 72 hours. Heavy mixed spoilage occurred and surface contamination, although high in all carcases, though less so in the sprayed side. *Proteus vulgaris* was seen and other non-lactose fermenting gram-negative rods were prominent.

Test 9—Cattle and sheep slaughtered in the K.M.C. abattoir, Mombasa, and retained in the hanging hall

The beef carcases reacted favourably to the antibiotic treatment. After 72 hours the intraperitoneally injected carcase was still in perfect condition, its deep tissue count showing only 3,000 organisms per gramme, though the control showed signs of decomposition with a deep count of 6,000,000 organisms per

TRIAL 8
DEEP TISSUE COUNT PER GRAMME

	Code	Age hour	Total Aerobic	Streptococci	Staphylococci	Clostridia	*p*H	Organoleptic
CATTLE								
Sprayed	MH1	24	40,000	< 1,000	< 1,000	< 1,000	5·7	Normal
	MH2	48	11,000,000	80,000	1,000	< 1,000	6·1	Normal
	MH3	72	140,000	4,000	< 1,000	< 1,000	5·8	Strong odour
Control	MJ1	24	70,000	13,000	11,000	< 1,000	5·4	Normal
	MJ2	48	32,000,000	160,000	39,000	20,000	6·0	Putrid
	MJ3	72	110,000	24,000	6,000	120,000	6·4	Putrid
Intraperitoneal	MK1	24	16,000	3,000	< 1,000	< 1,000	5·5	Normal
	MK2	48	3,300,000	50,000	< 1,000	< 1,000	5·6	Normal
	MK3	72	34,000	21,000	1,000	< 1,000	5·9	Slight odour
SHEEP								
Sprayed	MP1	24	22,000	3,000	< 1,000	< 1,000	5·9	Normal
	MP2	48	27,000,000	12,000	70,000	< 1,000	5·9	Slight odour
	MP3	72	90,000,000	210,000	170,000	6,000	6·3	Moderate odour
Intraperitoneal	MQ1	24	3,000	< 1,000	1,000	< 1,000	6·0	Normal
	MQ2	48	6,000,000	1,000	7,000	1,000	6·1	Putrid smell
	MQ3	72	130,000,000	100,000	24,000	1,000	6·0	Putrid smell
Dipped	MR1	24	9,000	4,000	< 1,000	< 1,000	6·0	Normal
	MR2	48	21,000,000	100,000	100,000	< 1,000	5·8	Very strong odour
	MR3	72	160,000,000	530,000	850,000	3,000	6·3	Putrid
Control	MS1	24	240,000	124,000	72,000	< 1,000	5·9	Normal
	MS2	48	130,000,000	230,000	1,050,000	800,000	6·0	Putrid
	MS3	72	900,000,000	3,000,000	> 5,000,000	10,000,000	7·0	Putrid

Temperature : 24 hours — 91°, 48 hours — 84°, 72 hours — 85°.
Humidity : 24 hours — 72 per cent., 48 hours — 80 per cent., 72 hours — 85 per cent.

	SWABS — TOTAL AEROBIC COUNT PER SQUARE FOOT		
	24 hours	48 hours	72 hours
CATTLE			
Sprayed MH	6,000,000	52,000,000,000	11,000,000,000
Control MJ	51,000,000	560,000,000,000	44,000,000,000
Intraperitoneal MK	3,300,000	43,000,000,000	27,000,000,000
SHEEP			
Sprayed MP	220,000,000	10,000,000,000	70,000,000,000
Intraperitoneal MQ	14,000,000	17,000,000,000	220,000,000,000
Dipped MR	40,000,000	180,000,000,000	90,000,000,000
Control MS	30,000,000,000	41,000,000,000	1,100,000,000,000

gramme. The sprayed carcase was quite normal at the second testing taken at 10 a.m. with a *p*H of 5.6. At 3 p.m. on the same day, putrefaction suddenly set in with a greenish discoloration, first noticed around the gracilis muscle. When tested after 72 hours signs of typical decomposition without the presence of Clostridia were apparent. The *p*H reading was then 6.2, the deep tissue count amounting to 11,000 organisms per gramme and the surface count to 8,000,000 per sq. ft. as compared with 600,000 and 9,000,000,000 in the control carcase. This result was not unexpected, as the animal was the poorest and oldest of this experimental batch.

The sheep carcases showed little resistance to decomposition and, after 30 hours, all sides were covered visibly with yeasts. Slight clostridial putrefaction developed after 72 hours in the intraperitoneally injected carcase which, it must be emphasised, was derived from the poorest sheep of the batch. Surface counts, although very high, remained comparatively lowest in the sprayed and dipped sides.

The bacterial flora showed numerous gram-negative, non-lactose fermenting bile tolerant type organisms, often with considerable numbers of Serratia.

Assay for Residual Antibiotic

At the same time as each sample was taken for *p*H and bacteriological tests, a sample was also assayed for terramycin hydrochloride using the plate method. It was found that heavy bacterial contamination interfered with these results. Large inhibition zones were recorded for samples which had had no antibiotic treatment but supported a heavy bacterial flora.

For example, the control sheep in Test 9 at Mombasa assayed as follows:—

24 hours—0.70 mcg. per gramme; 48 hours—2.27 mcg. per gramme; 72 hours—0.03 mcg. per gramme.

Thus inhibition zones in heavily contaminated carcases may have been entirely due to bacterial products or partly due to bacterial products and partly due

TRIAL 9

DEEP TISSUE COUNT PER GRAMME

	Code	Age hour	Total aerobic	Streptococci	Staphylococci	Clostridia	*p*H	Organoleptic
CATTLE								
Sprayed	ME1	24	15,000	1,000	< 1,000	< 1,000	5·8	Normal
	ME2	48	500,000	1,000	< 1,000	< 1,000	5·6	Normal
	ME3	72	11,000	3,000	< 1,000	< 1,000	6·2	Putrid smell
Control	MF1	24	1,000	< 1,000	< 1,000	< 1,000	5·4	Normal
	MF2	48	600,000	1,000	1,000	< 1,000	5·5	Normal
	MF3	72	600,000	7,000	2,000	< 1,000	5·9	Slight odour
Intraperitoneal	MG1	24	80,000	< 1,000	< 1,000	< 1,000	5·5	Normal
	MG2	48	100,000	< 1,000	< 1,000	< 1,000	5·6	Normal
	MG3	72	3,000	< 1,000	< 1,000	< 1,000	5·7	Normal
SHEEP								
Sprayed	ML1	24	2,000	< 1,000	< 1,000	< 1,000	5·7	Normal
	ML2	48	11,000,000	16,000	31,000	< 1,000	5·9	Normal
	ML3	72	300,000	11,000	4,000	< 1,000	6·1	Strong odour
Intraperitoneal	MM1	24	19,000	1,000	< 1,000	< 1,000	5·7	Normal
	MM2	48	13,000,000	120,000	37,000	< 1,000	6·1	Slight odour
	MM3	72	16,000,000	43,000	6,000	5,000	6·2	Slight odour
Dipped	MN1	24	5,000	< 1,000	< 1,000	< 1,000	5·8	Normal
	MN2	48	12,000,000	120,000	70,000	< 1,000	6·0	Normal
	MN3	72	80,000,000	490,000	> 500,000	< 1,000	5·8	Moderate odour
Control	MO1	24	50,000	14,000	4,000	< 1,000	5·9	Normal
	MO2	48	31,000,000	27,000	200,000	2,000,000	6·0	Putrid
	MO3	72	190,000,000	1,210,000	> 500,000	10,000,000	6·9	Putrid

Temperature : 24 hours — 83°, 48 hours — 80°, 72 hours — 85°.
Humidity : 24 hours — 84 per cent., 48 hours — 87 per cent, 72 hours — 74 per cent.

SWABS — TOTAL AEROBIC COUNT PER SQUARE FOOT

	24 hours	48 hours	72 hours
CATTLE			
Sprayed ME	220,000,000	<1,000,000	8,000,000
Control MF	130,000,000	3,000,000,000	9,000,000,000
Intraperitoneal MG	370,000,000	1,000,000	5,000,000,000
SHEEP			
Sprayed ML	810,000,000	17,000,000,000	11,000,000,000
Intraperitoneal MM	250,000,000	3,000,000,000	28,000,000,000
Dipped MN	600,000	2,500,000,000	7,000,000,000
Control MO	30,000,000,000	220,000,000,000	100,000,000,000

to antibiotic treatment. In 2 tests, however, bacterial development was negligible, and these provide valid data of terramycin hydrochloride persistence at low and high temperatures.

Test 1. Cattle at approximately 40° F. at Athi River:—

Sprayed	B1	24	hours	—1.03	mcg.	per gramme
,,	B2	48	,,	—0.03	,,	,, ,,
,,	B3	72	,,	—0.03	,,	,, ,,
Injected	D1	24	,,	—1.11	,,	,, ,,
,,	D2	48	,,	—1.16	,,	,, ,,
,,	D3	72	,,	—1.18	,,	,, ,,

Test 4. Cattle " bush slaughtered " at Athi River and hung in open:—

Sprayed	K1	24	hours	—0.03	mcg.	per gramme
,,	K2	48	,,	—0.03	,,	,, ,,
,,	K3	72	,,	—0.03	,,	,, ,,
Injected	M1	24	,,	—1.17	,,	,, ,,
,,	M2	48	,,	—1.14	,,	,, ,,
,,	M3	72	,,	—1.16	,,	,, ,,

Thus intraperitoneal injection of 15 grammes Biostat per 1,000 lb. live-weight gives a persisting residue of just over a microgramme per gramme of muscle tissue for at least 3 days. Using the spray method, however, antibiotic was not detected after the first day.

Although treated samples were assayed before and after cooking, non-specific interference, probably bacteriological, again occurred. There did, however, appear to be a marked fall in antibiotic titre.

Discussion

The meat hygienist's well-established view was again confirmed by these trials. The keeping quality of meat depends primarily upon the health of the animal, its condition, the rest and water provided prior to slaughter, and the degree of bleeding and cooling of the carcase. It is not deep spoilage which threatens meat derived from proper slaughter but surface contamination resulting from the unhygienic handling of carcases and the use of unclean transport (Lepovetsky *et al.*, 1953). Spoilage in healthy meat has its origin on the surface and penetrates the deeper layers following the course of connective tissue, nerves, blood, and lymph vessels (von Ostertag, 1955). It is therefore obvious that the surface must be afforded protection if the storage life of meat is to be prolonged. Improved hygiene and low temperature are fulfilling this demand, but where mechanical preservation presents difficulties, a substitute must be found to extend the keeping quality of this valuable animal protein.

To test the effect of oxytetracycline as a preservative in fresh beef, Sacchi *et al* (1955), in the Isle of Cuba, treated 6 cattle intraperitoneally with this drug. The injected carcases were then hung for 2 days at " room temperature," during a time when out of doors the day-time heat reached 32-5° C. and the " relative humidity was apparently quite high," though not recorded by the authors. In these conditions, the control carcase developed a very bad odour, " typical of putrefaction, and gas from deep-seated spoilage bacteria bubbled to the surface in many spots. The control also had areas which were slimy and a semi-liquid, fatty material dripped from other portions," —a dramatic description indeed. However, despite the fact that our tests were carried out in worse conditions, no protruding gas bubbles were noted in the controls after 72 hours nor were we able to confirm the presence of a dripping, " semi-liquid, fatty material," even in the fat-tailed native sheep. It is, of course, possible that these violent changes were provoked by the initial handling of the 6 beasts. " It became necessary to tie the animals to a strong fence and hold them in place by pressing a swinging gate against their right side." The effect of such excitement 2 hours prior to slaughter may have lead to the early decomposition of the meat. For this reason, a crush was used in these trials for immobilising the beasts. The positive results obtained by Sacchi *et al.* with the intraperitoneal injection with oxytetracycline were, however, fully confirmed in these trials with Biostat.

Although in its present form and strength this antibiotic cannot replace cold storage, it is able to prolong the keeping quality of meat to such an extent as to satisfy the meat trade in hot and under-developed countries. The butcher of these lands is not usually concerned about keeping beef for weeks or months in a fresh and consumable state. He is, however, interested in preserving beef for at least 24 to 72 hours, that being the average time required for the sale of all meat derived from one bovine carcase. By the use of Biostat in the concentration prescribed by the makers, it was found possible to achieve this aim. Beef, slaughtered even in the most adverse conditions, resisted putrefaction up to 48 hours. Also the initial deep contamination of the treated carcases was very low if one considers Elford's (1936) recommendation, adopted by Portland-Oregon, that 10,000,000 organisms per gramme of ground meat are acceptable for human consumption.

The contaminating organisms were mainly non-lactose fermenting gram-negative rods, and micrococci, whilst streptococci, usually faecalis but sometimes lactis or Type D, formed a variable proportion of the spoilage organisms. Lactobacilli and yeasts were generally not prominent although a heavy surface growth of an imperfect yeast of the genus Trichosporon occurred on the sheep carcases in Mombasa. Of the gram-negative rods, the frequent dominance on the sheep carcases of Proteus spp., a genus with a high natural drug tolerance, may give cause for concern. From the Public Health aspect (B.V.A. Conference, 1956) of great importance is the fact that treated carcases resisted clostridial spoilage, and coagulase positive staphylococci were suppressed.

The appearance of the treated carcases was better than that of the controls, but claims that an antibiotic has a tenderising effect could not be substantiated (Taylor, 1956).

The methods of application of an antibiotic can be divided into 2 groups, *ante* and *post mortem*. The intraperitoneal injection method into the paralumbar fossa 2 hours prior to slaughter affords the best deep protection to the meat. The injected Biostat seems to diffuse towards the surface, its inhibitory action

there becoming obvious towards the third day. Thus it both counteracts the development of deep-seated organisms and reduces the surface growth of bacteria. While this result is satisfactory, the practical application of the intraperitoneal injection is complicated. It is doubtful whether the meat industries will agree with Sacchi *et al.* (1955), that to drive a beast 2 hours prior to slaughter into a chute is a procedure suitable for "commercial slaughter-houses." While it could be applied in a small slaughter-house, it would upset routine procedure in an abattoir slaughtering 50 or more cattle per day. Even with the best immobilisation methods cattle brought from a ranch or the bush cannot readily be driven into such restraint. In addition the animal is upset and valuable time is wasted. An acceptable method should be simple in application with no undue strain upon the slaughter animal and must fit into normal routine abattoir procedure. It is felt that the spray method, which in its effect is as good if not better than the intraperitoneal, and as for checking surface contamination, definitely the best one, should find application. It is a simple means of introducing the antibiotic and can be fitted into normal slaughter-house routine. At the end of the dressing line, where carcases are trimmed and cleansed of blood and other impurities, a pressure shower is now installed in all up-to-date abattoirs. The combination of this shower with an antibiotic spray would solve the problem of applying Biostat. The carcase should then be allowed to cool and dry off on the surface in a well-ventilated hanging room before its issue to the meat trade.

The dipping method (Kohler *et al.*, 1954; Tarr *et al.*, 1952) is in effect similar to the spray but is more difficult to apply. It can be used for small stock only and requires the removal of the carcases from the overhead runway and a continuous change of the dipping fluid which itself necessitates the use of more antibiotics and so involves additional expense. Moreover, the dipped carcases tend to be saturated with water and consequently require extra time and space for drying.

The whole subject of antibiotics and the development of resistant strains has led to heated controversy (Tarr *et al.*, 1952; B.V.A. Conference, 1956; Krucken, 1957). From the technological viewpoint of meat production the primary considerations are of an economic nature and the significance of the development of possible resistant strains must be assessed in terms of the existing reports on experimental work. American opinion is that, if the development of resistant strains were a real risk, evidence by this time would have been overwhelming, but British workers also state that at least 100 kg. of freshly treated meat would have to be consumed to equal a therapeutic dose of 0.5 gramme (Ingram *et al.*, 1955). A great deal more would have to be consumed when the meat has been stored for any length of time or cooked prior to consumption, as both procedures destroy the vitality of broad-spectrum antibiotics as was again proved in these trials. Besides, it should be noted that the application of antibiotics by spraying or dipping introduces negligible amounts of the drug into the muscles only.

In Britain, antibiotics have been fed to pigs and poultry since 1953 and the benefits of this are well established (B.V.A. Conference, 1956). Many producers of animal feeding-stuff as well as farmers have been handling antibiotics for the past 7 years, but we believe that no sensitivity has yet been reported despite the fact that the doses greatly exceeded any which could be acquired from meat treated with antibiotics. The available evidence therefore suggests that the use of antibiotics in the preservation of fresh meat does not constitute a hazard to public health. As, however, the use of preservatives has, in the past, been frequently permitted before their being subjected to adequate investigation, it is understandable that the public health worker of the present day demands more data before sanctioning their use. But even if no danger exists from the addition of well-established quantities of antibiotics to fresh meat, methods governing their use must be laid down by law as the indiscriminate application of any preservative is a practice to be avoided. Preservation, it should be clearly understood, was never intended to replace hygiene nor to cover up developing spoilage but to prolong the freshness of foods under commercial conditions and afford protection when unforeseen delay occurs during normal distribution.

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The Surgical Treatment of a Case of Obstructive Jaundice in the Dog

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SUMMARY.—An account of the diagnosis of a case of obstructive jaundice in the dog is given and an operation for the relief of the obstruction is described. Although the aetiology of the condition is obscure a possible explanation is suggested.

Introduction

A SURVEY of the available literature shows that obstructive jaundice is uncommon in the dog and, furthermore, no account of any operation performed for its surgical correction can be found. For this reason it is felt that this case should be reported.

Case Report

An 8-year-old Bull Mastiff bitch was presented at the hospital on April 25th, 1957, with a history of intermittent vomiting for 2 months, during which time her appetite had been poor, she had lost condition and become jaundiced. Her urine was reddish-brown in colour and her faeces soft and pale. On questioning, the owner stated that the bitch had suffered from some acute undiagnosed condition of the alimentary tract, about a year previously.

When examined the animal was seen to be grossly emaciated and obviously jaundiced. Her pulse rate was 120 beats per minute whilst her respiratory rate and temperature were normal. Her mouth was dry and her tongue brown and furred. Her eyes were sunken and her skin was less pliable than normal.

A lateral radiograph of the abdomen showed the presence of some dense fragments (? bone) possibly in the small intestine.

Laboratory tests of liver function were confined to the examination of a small quantity of blood and a urine sample because it was considered that further interferences were not justified in view of the animal's poor condition.

Urine Analysis.—Colour deep gold ; turbid. Protein —trace ; bilirubin ++++ ; bile salts—trace.

Blood Examination.—Haemoglobin 15·4 gms. per 100 ml.

Electrophoresis on Serum.—Increased level of α globulin and decreased level β globulin.

In haemolytic jaundice the haemoglobin level falls very rapidly and in endogenous jaundice bile salts would not be expected to be present in the urine. Furthermore, the electrophoresis pattern associated with endogenous jaundice shows a raised γ globulin level (Campbell, 1957). In both haemolytic and endogenous types of jaundice the history is that of an acute illness and there is often fever.

On these grounds a diagnosis of obstructive jaundice was made and an exploratory laparotomy was performed on April 26th, 1957, to discover the cause of the obstruction and attempt to relieve the condition.

Operation

Premedication consisted of scopolamine gr. 1/150 and pethidine hydrochloride mg. 100 given by subcutaneous injection. Anaesthesia was induced 1 hour later with 0·35 g. of thiopentone sodium solution administered intravenously. After intubation with a No. V 12 cuffed endotracheal tube anaesthesia was maintained by cyclopropane and oxygen using the closed-circuit technique. Muscle relaxation was obtained by the intravenous injection of 15 mg. of d-tubocurarine chloride, respiration being controlled (Hall & Weaver, 1954). Spontaneous respiration was restored at the conclusion of the operation by the intravenous injection of atropine gr. 1/100 and prostigmine mg. 2·5.

A mid-line incision was made from the xiphisternum to a point 2 in. posterior to the umbilicus. On entering the abdomen it was seen that the omentum was contracted down and folded upon itself between the greater curvature of the stomach and the spleen. A lesion, which resembled a scar formed after a perforation, was visible on the stomach wall and on the medial border of the spleen there was a small abscess. The proximal part of the small intestine was dilated, with a thickened inflamed wall, and there was a stenosis, caused by a band of fibrous tissue, about the middle of the jejunum. Distal to this stenosis the intestines appeared to be normal. The liver was normal in position, size and shape but the pattern of the lobules was very clearly demarcated by the gross distension of the biliary sinusoids and the whole organ was discoloured by the

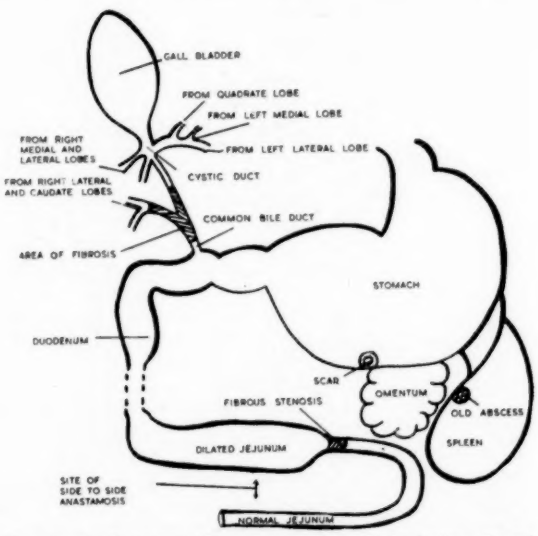

FIG. 1.—A diagrammatic representation of the lesions found on laparotomy.

retention of the bile. The gall bladder was very distended and so were the ducts from the main mass of the liver and from the right lobe. About the point of junction of this latter duct with the common bile duct there was a sudden narrowing which, on palpation, was found to be due to a fibrous constriction extending a short way from this point towards the duodenum (See Fig. 1).

An attempt was made to dissect the bile duct free from the fibrous tissue and so restore its normal patency but this could not be achieved. Therefore the distended duct was incised and the dark, viscid bile removed by suction prior to the restoration of the continuity of the duct system by cannulation.

A ligature of No. 35 linen thread was laid loosely round the common bile duct distal to the fibrous area. The duct was then incised between the stenosis and the duodenum and 2 lengths of 2·0 mm. bore polythene tubing were introduced into it and worked down through the sphincter of Oddi into the duodenum. This was immediately followed by a slight reflux of intestinal contents into the tubes. The tubes were advanced about 1 in. into the duodenum and the ligature tied, fixing them securely into position. After flushing with sterile saline the tubes were clamped to prevent further reflux of intestinal contents. Linen thread ligatures were then loosely laid round the common bile duct above the site of obstruction and around the duct from the right lobe of the liver. One polythene tube was introduced, *via* an incision, into each of the ducts, the ligatures tied and the clamps removed (Fig. 2). In a very short time bile was seen to be flowing freely down both tubes and there was no apparent leakage of bile, round the tubes, up to the time the abdomen was closed.

The stenosed area of the jejunum was by-passed by means of a side-to-side anastomosis (Markowitz, Archibald & Downie, 1954). The peritoneum and muscles were closed in one layer with interrupted sutures of No. 60 linen and the skin with interrupted sutures of No. 4 green, monofilament nylon.

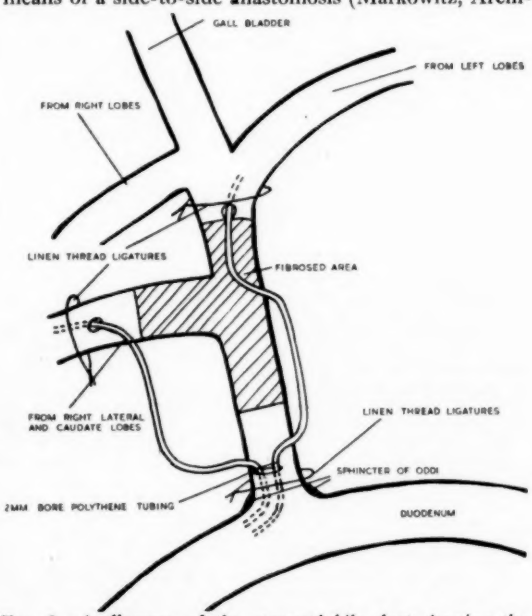

FIG. 2.—A diagram of the stenosed bile duct showing the position of the polythene tubes inserted for the relief of the condition.

During the operation and immediately post-operatively the animal received 250 ml. of normal saline, 500 ml. of homologous plasma and 500 ml. of normal saline containing 500 mg. of intravenous oxytetracycline.*

Subsequent Progress

During the post-operative period until the animal was discharged from the hospital on May 10th, 1957, there was no sign of pyrexia or pain and she received 500,000 I.U. crystalline sodium penicillin by subcutaneous injection daily. However, the animal's condition did vary from day to day :—

April 26th.—Operation.

April 27th.—Complete anorexia. Urine but no faeces passed. Intravenous drip infusion of 750 ml. dextrose + 100 ml. protein hydrolysate + 2 ml. vitamin B complex† + 200 micrograms vitamin B_{12}†. Vitamin A 100,000 I.U. was given by intramuscular injection.

April 28th.—Some water taken. Urine and also soft, grey faeces passed. Marked decrease in jaundice.

April 29th.—Gravy and water taken. Normal coloured faeces passed.

April 30th.—No gravy and only a little water taken. No faeces passed.

May 1st.—A little food and water taken by mouth. Jaundice less pronounced. Intravenous drip infusion of 500 ml. saline + 100 ml. protein hydrolysate, + 2 ml. vitamin B complex + 200 micrograms vitamin B_{12}. Also vitamin A 100,000 I.U. by intramuscular injection. Urine analysis : protein negative ; bilirubin ++++ ; bile salts ++.

May 2nd.—Animal showed some interest in food. Faeces passed. Small amount of food, vomited in the evening. The vitamin A, B complex and B_{12} therapy was continued daily by intramuscular injection up to, and including, May 6th.

May 3rd.—A little food and water taken.

May 4th.—Some food and water taken.

May 5th.—Owners visited and animal appeared brighter in their presence. Some food and water taken.

May 6th.—Ate a good meal, a little of which was vomited back later. Animal brighter. Sutures removed; wound healed by first intention. Urine analysis : bilirubin +++ ; bile salts +++ ; colour much less intense, turbidity now slight.

May 7th.—Complete anorexia.

May 8th.—A little food and water taken. Jaundice clearing.

May 9th.—Fairly bright. It was decided that the animal would probably eat better at home.

May 10th.—Discharged from hospital in afternoon.

Subsequently the owners wrote and reported that after returning home the animal ate very little food, continued to lose condition and finally died on May 21st.

Discussion

Polythene tubes were used to reconstruct the bile duct system because they were readily available but their use was perhaps justified since there are favourable reports of the behaviour of polythene when implanted

* Terramycin—Pfizer, Ltd. † Crookes.

in body tissues. Brown *et al.* (1947) report the use of polythene implants in this and other types of operation and appear very enthusiastic about its use. Farquhar & Lewis (1948) make the point that no plasticiser or antioxidant is used in making British polythene products and the possibility of tissue reaction due to the presence of these substances is eliminated.

Quite apart from the problems of diagnosis and treatment the aetiology of this case is very interesting. A logical, and possibly correct, explanation is that the illness which occurred 12 months ago was due to perforation of the gastric wall by fragments of ingested bone. It is suggested that this caused three areas of peritonitis—on the spleen, jejunum and bile duct. The omentum, and antibiotics given at the time, controlled and localised these areas, the main mass of the omentum contracting round the gastric perforation and actually entangling the pieces of bone. The areas of inflammation became organised with the formation of fibrous tissue. However, movement of the animal and peristalsis resulted in tearing of the fibrous tissue causing more exudation and more fibrosis around both the jejunum and bile duct.

Following the operation bile was evidently reaching the intestines either in large amounts or concentrated form and the liver was not able to clear the relatively large amounts of urobilinogen reabsorbed from the intestine. This is shown by the analysis of the urine samples obtained on May 1st and 6th which showed a slight decrease in bilirubin and a marked increase in bile salts. The slight fall in bilirubin can be correlated with the clearing of the jaundice and may be taken as an indication that bile pigments were gradually being cleared from the body. In both urine samples there was a high level of urobilinogen—2·0 mg. per 100 ml. as estimated by the method of Schwarz, Sborow & Watson (1944). Although no normal figures are available for the dog, in man the normal level is quoted as 0·8 to 1·0 mg. per 100 ml. (Varley, 1954).

These findings would have been more significant if urobilinogen estimation had been also carried out on the faeces.

It is unfortunate that the cadaver was not available for *post-mortem* examination but it would appear that, whilst the operation was surgically successful, the damage to the liver had progressed so far before operation that recovery was impossible.

Acknowledgments.—I should like to thank Professor L. P. Pugh for permission to publish this article and also the members of the Cambridge School of Veterinary Medicine for the help they have given in its preparation.

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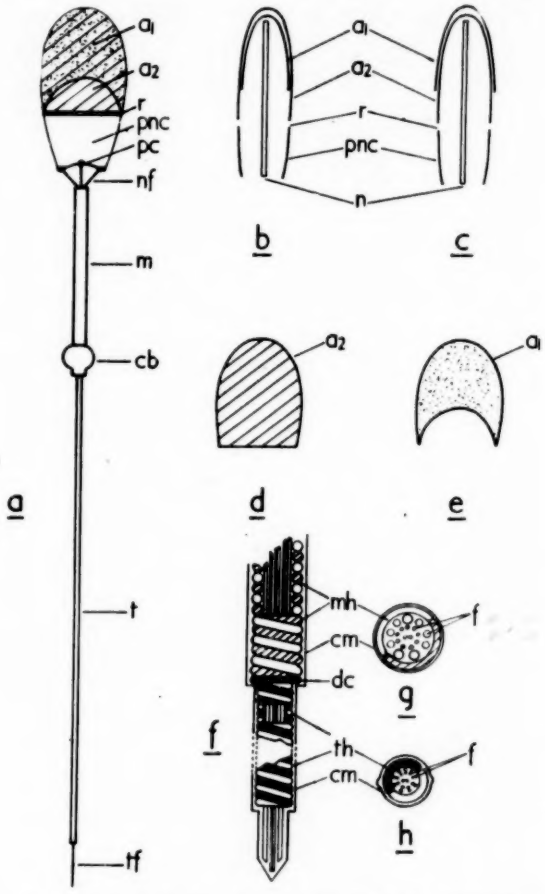
In Brief

THE STRUCTURE OF SPERMATOZOA

The spermatozoa of the domestic ungulata (bull, ram, boar and stallion) show broadly similar morphological features; these are shown diagrammatically in Fig. a. The head is a paddle-shaped structure which is attached at the neck to a long flagellum, the tail.



a, Diagram of the main components of the mammalian spermatozoon; b, Longitudinal vertical section of the head of the boar spermatozoon (Hancock, 1957); c, Longitudinal vertical section of the head of the ram spermatozoon; after Randall & Friedlaender (1950); d, Plan view of the larger component of the acrosome (a_2); e, Plan view of the smaller, crescentic component of the acrosome (a_1); this is the galea capitis of Blom (1945); f, Diagrammatic reconstruction of the partly dissected middle-piece and tail; after Challice (1952) and Bradfield (1953, 1955); g, Transverse section of middle-piece (Bradfield, 1955); h, Transverse section of main tail-piece (Bradfield, 1955).

ABBREVIATIONS USED IN TEXT FIGURES

a_1, Smaller component of acrosome (galea capitis); a_2, Larger component of acrosome; r, Nuclear ring; pnc, Post-nuclear cap; pc, Proximal centriole; nf, Neck fibres; m, Middle-piece; cb, Cytoplasmic bead or droplet; t, Main tail-piece; tf, Terminal filament; mh, Mitochondrial helix; cm, Cell membrane; f, Fibrils of middle-piece and tail; dc Distal centriole; th, Tail helix.

The tail has two main components, the middle-piece and main tail-piece. The head is covered in front by a cytoplasmic cap-like structure which is here referred to as the acrosome. The reconstruction of the head in Figs. b and c show two possible interpretations of the structure of the acrosome and Figs. d and e show, separately, two probable components of the acrosome. There are certain objections to the interpretation given in Fig. c ; Fig. b is based on recent findings on the structure and development of bull and boar spermatozoa (Hancock & Trevan, 1957 ; Hancock, 1957). One of the two components of the acrosome (Fig. e) resembles, and may be identical with, the structure known as the galea capitis (Blom, 1945). The surface of the area of the head caudal to the acrosome is readily impregnated with silver and this area is usually referred to as the post-nuclear cap. The common boundary of the acrosome and post-nuclear cap forms the nuclear ring. The equatorial segment is shown in Fig. a as a segment-shaped area in front of the nuclear ring. It is an inconstant feature of the bull spermatozoon and its precise identity is still controversial but differences in the appearance of this feature are clearly related to differences in the structure of the acrosome before and after death of the cell (Hancock, 1952) and to species differences in the structure of the acrosome (Hancock, 1957).

Little can be seen with the light microscope of the structure of the neck but in suitable Giemsa-stained preparations three neck granules are visible ; the central granule is probably the proximal centriole. In certain circumstances the two lateral granules only can be seen (Morris, 1950 ; Hancock, 1953). There is some evidence that the component fibrils of the tail are inserted into the head in three bundles (Bretschneider, 1949 ; Bradfield, 1955) ; the points of insertion may correspond to the neck granules seen in stained preparations.

With the light microscope, the middle-piece normally shows no differentiation except for the presence in some spermatozoa of a bead or droplet of cytoplasm. Investigations with the electron microscope have shown that the tail is composed of a number of fibrils. In the middle-piece there are two sets, each of nine fibrils, arranged concentrically ; a central pair of smaller fibrils run the whole length of the flagellum. In the main tail-piece the double set is reduced to a single set of nine double fibrils surrounding the central pair. This structural pattern of a ring of nine fibrils surrounding an inner pair is a basic feature of all animal and plant flagellae so far investigated (Bradfield, 1953, 1955).

In the middle-piece the fibrils are surrounded by a double helix of mitochondria. A separate double helix of some fibrous protein surrounds the fibrils of the main tail-piece. These features are illustrated in Figs. f, g and h. The helix does not extend to the tip of the tail—the naked terminal filament can be distinguished from the rest of the tail, even with the light microscope.

J. L. HANCOCK (April, 1957.)

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Current Literature

ABSTRACTS

Further Aspects of Bemegride Activity and its Relation to Barbiturate Action. SHULMAN, A. (1956). *Aust. J. Exp. Biol. Med. Sci.* **34.** 472-7.

Further evidence is provided of the use of the drug Bemegride (β-methyl-β-ethylglutarimide, Megimide, NP 13) as a barbiturate antagonist. Its action, which appears to be by a selective specific displacement mechanism, is largely dependant on the quantity and rate of its administration both in man and animals. If given intravenously slowly, an asymptomatic awakening usually results. Rapid intravenous injection, however, produces cerebral excitement and convulsions after which the subject relapses into a state of deep coma; a further slow intravenous injection of the drug will effect an awakening. The cat usually cannot be fully awakened from barbiturate narcosis, but the rabbit can be readily awakened and put to sleep by the alternate intravenous administration of Bemegride and thiopentone sodium.

L. C. V.

The Effect of Caponising and Oestrogen Treatment on the Performance of New Hampshire Cockerels. LAUFFER, R. G. (1957). *Poult Sci.* **36.** 376-7.

The authors compared the carcase weight and finish of oestrogen-treated birds with those of untreated controls and of birds caponised surgically at 4 weeks of age. The birds were killed at 13 and 24 weeks of age. The oestrogen treatment given to birds killed at 13 weeks of age comprised either implantation with 15 mg. of diethylstilboestrol at 8 weeks, or feeding dienoestrol diacetate in the mash at the rate of 31.75 mg. per lb. from the 10th to the 13th week of life. Those killed at 24 weeks received a second implantation at 19 weeks, or a further course of medicated food from the 21st to 24th week.

At 13 weeks the birds treated orally were significantly heavier, and all the oestrogen-treated groups showed superior finish, feathering, and food conversion efficiency. At 24 weeks the oestrogen-treated groups were significantly heavier and of superior finish and feathering.

E. A. G.

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News and Comment

THE AGRICULTURAL RESEARCH COUNCIL

The Agricultural Research Council announce the appointment of Professor J. H. Gaddum, M.A., SC.D., M.R.C.S., L.R.C.P., F.R.S., F.R.S.E., as Director of their Institute of Animal Physiology, Babraham, Cambridge, as from September 30th, 1958, when Dr. I. de Burgh Daly, M.A., M.D., F.R.C.P., F.R.S., the present Director of the Institute, will be retiring on grounds of age. Professor Gaddum has been Professor of Materia Medica in the University of Edinburgh since 1942. He was a member of the Medical Research Council from 1948 to 1951.

N. WALES DIVISION ANNUAL DINNER

We are asked to announce that, owing to the difficulties caused by an outbreak of foot-and-mouth disease in the area, the Division's annual dinner-dance, arranged for November 1st, has had to be cancelled.

UNIVERSITY NEWS

London

The official opening of the session was held at the Royal Veterinary College on September 30th, when the prizes for the previous session were presented by Sir Weldon Dalrymple-Champneys, Bt., formerly Deputy Chief Medical Officer at the Ministry of Health. Professor Sir Charles Lovatt Evans, Chairman of the Council, presided, supported by the Principal, Dr. R. E. Glover. With them on the platform were Lt.-Col. Sir Merrik R. Burrell, Bt., Vice-Chairman of the Council, and Professor J. McCunn, Vice-Principal. Among the guests were Mr. G. Clark (Deputy Academic Registrar and Secretary to the Collegiate Council of the University of London), Professor C. T. Ingold (Dean of the Faculty of Science), Mr. G. N. Gould (President of the Royal College of Veterinary Surgeons) and Mr. W. G. R. Oates (Registrar), Mr. J. M. Ingram (President of the British Veterinary Association), Major The Hon. Carol Fellowes (Assistant Secretary of the Royal Agricultural Society of England), and Dr. R. Scarisbrick (Deputy Chief Scientific Officer of the Agricultural Research Council). A number of members of the Council of the College attended.

The prize-winners were as follows:—

J. D. O'Shea, G. G. Prosser, D. C. Lang, T. Van Laun, E. W. Winstanley, R. Bradley, A. B. Farrow, D. W. Christie, Janet E. Gibbons, J. P. Jarvis, R. M. Connan, M. T. Greenwood, A. Boothroyd, D. G. Porter, J. R. Simmons, T. P. Price, N. W. Richards, F. M. Robinson, and D. G. Whittingham.

Veterinary Pre-clinical Examination: Part I

Baxter, Richard Geoffrey; Bowden, Nelson Lester Rufus; Bradley, Robert Harry; Carter, James Gordon; Coffey, David John; Cryer, John Michael; Cullen, Gavin Anthony; David, Jeremy Giles; Davies, Robin Cemes; Davis, David André Theresa; Denny, David John Bibby; Dyson, John Anthony; Farr, Neal Haywood; Finch, Barry Charles; Fox, Michael Wilson; Geeson, Leonard Charles; Gerring, Ernest Edward Lawrence; Gordon, Michael Allen; Gough, Roy George; Grafton, Christopher Gordon; Gwynn, Robert Vernon Roy; Hampshire, Sheila Ann; Harrison, Brynle; Hawken, Michael Lynn; Heron, Jane Maxwell King; Houldgreaves, Ian David; Hudd, David Lionel; Hunt, Catherine May Macdonald; Jones, Martin; Keele, John Anthony; Khin-Maung-Myint; Knights, Geoffrey William; Morley, Peter William George; Mount, Edward Phillip; Nsubuga, Herbert Semu Kanabi; Peters, Gillian; Pooley, Bryan Robert; Porter, David George; Pout, Derek Dudley; Price, Thomas Philip; Richards, Nigel William; Riley, Sylvia Marilyn; Robinson, Frederick Michael; Russell, Alexander Milton; Saunders, John George; Simmons, John Rider; Sismey, Ronald; Spurrell, Andrew Pritchard; Staton, James Frederick; Stevens, Roger Christopher Kirk; Stockdale, Peter Howard Gough; Tarttelin, Michael Frank; Thompson, Jill; Vanderplank, John Alexander; Walker, Roger William John; Watkins, Cecil William; Whittingham, David Gordon; and Williams, David Rhys.

Veterinary Pre-clinical Examination: Part II

Barber, Kenneth William; Bleby, John; Callaghan, John Barrie; Challis, David John; De Vile, Christopher Paul; Earp, Barry Ogilvie; Entwisle, John Malcolm; Goni, Musa; Hanson, Alan Arthur; Hazzard, Terence Cuthbert; Jarvis, James Peter; Jones, Keith Rowland Morgan; Lorenzen, Charles Christopher Martin; Pabs-Garnon, Leonard Frederick; Poulter, David Arthur Leslie; Quest, John Averill; Randall, Peter Mead; Redfern, David Michael; Robertson, David Gilbert; Smith, John Stroyan; Stock, John Edward; Stockley, Rachel Elizabeth; Thompson, Filmer George Auger; Walker, Ian Edward; Walker, Patricia Jean; and Woodham, Clive Bernard.

The following Candidate has satisfied the Examiners in the qualifying examination prescribed in connexion with Higher Degree Registration:—

Puri, Bimla.

B.Vet.Med. Veterinary Clinical Examination: Part I

Bunner, John Kelvin; Daniels, Michael George; Davies, Edryd Morgan; Hitchcock, Percy Lewis; Jackson, Peter Stewart; Kamara, John Abu; Mallows, Bruce Alexander; Parkes, David Anthony; Porter, George; Seed, James Henry; Sinclair, Ian Willard; Thurley, David Crispin; Williams, David Penn; and Wrigley, Arthur.

LIBRARY ACCESSIONS

The list of library accessions in our issue of October 5th was that of the Royal Veterinary College, and not the Royal College of Veterinary Surgeons as stated. We regret any inconvenience caused to the libraries concerned.

THE REGISTER OF VETERINARY SURGEONS

The under-mentioned have been registered in the Commonwealth and Colonial List of the Register of Veterinary Surgeons under Section 13 (1) of the Veterinary Surgeons Act, 1881:—

Jackson, Cecil, B.SC. (RAND), B.V.SC., D.SC. (S. AFRICA), Animal Health Trust Canine Research Station, Kennett, Nr. Newmarket, Suffolk; October 3rd, 1957. Peppin, George Sydenham, D.V.M. (TORONTO), P.O. Box 317, Lethbridge, Alberta, Canada; October 3rd, 1957. Thorsen, Jan, D.V.M. (TORONTO), Veterinary Department, Kaduna, N. Nigeria; October 4th, 1957.

The names of the under-mentioned members have been removed (at their own request) from the Register of Veterinary Surgeons as from October 4th, 1957:—

Mr. Robert William Down, 23, Winchester Road, Andover, Hants, and Mr. Francis Richard Roche-Kelly, Glandwr, Bettws Garmon, Caerns.

THE VICTORIA VETERINARY BENEVOLENT FUND

The Annual Dance of the County of Ayr Ladies Guild will be held in Western House, Ayr, on Thursday, November 21st. Tickets, price one guinea, may be obtained from Mrs. A. L. Wilson, 31, Ashgrove Street, Ayr (Telephone: Ayr 65757).

THE CHEQUES ACT, 1957

The Cheques Act, which came into force this week, will have the effect, among others, of saving professional men and women both clerical work and petty cash. In most cases it is no longer necessary legally to send a receipt for any payment of fees, etc., made by cheque; the automatic return of the cheque to the client's bank after it has been honoured is now a sufficient receipt. This has the additional advantage of saving the cost of stamps which have hitherto had to be affixed to receipts for all sums exceeding £2.

PERSONAL

Births

ALLEN.—On September 9th, 1957, to Blanche, wife of P. V. Allen, M.R.C.V.S., of 146, Wadham Road, London, E.17, a son, Anthony Paul, a brother for Pauline and Barbara.

JAWARA.—On September 24th, 1957, at the Simpson Memorial Hospital, Edinburgh, to Hannah Augusta, wife of David K. Jawara, M.R.C.V.S., D.T.V.M., a son, David John Kairaba.

MURRAY-BROWN.—On October 9th, 1957, at Kinnelhook, Lockerbie, to Judith, wife of Ian Murray-Brown, M.R.C.V.S., B.V.M.S., a son.

NUNNELEY.—On October 13th, 1957, to Laurette, wife of David Nunneley, B.V.SC., M.R.C.V.S., of Lunsford Manor, Bexhill-on-Sea, a son, Christopher John.

COMING EVENTS

October

23rd (Wed.). Meeting of the R.A.V.C. Division at the Royal Veterinary College, London, N.W.1, 2.15 p.m.

25th (Fri.). General Meeting of the Yorkshire Veterinary Society in the Hotel Metropole, Leeds.
Meeting of the Society for the Study of Animal Breeding at the Royal Veterinary College, Camden Town, N.W.1, 11.30 a.m.

November

1st (Fri.). Annual Dinner Dance of the North Wales Division at the Imperial Hotel, Llandudno.
Autumn Meeting of the Eastern Counties Veterinary Society at the School of Veterinary Medicine, Madingley Road, Cambridge, 10.30 a.m.
Meeting of the Lincolnshire and District Division at the Eastgate Court Hotel, Lincoln, 2.15 p.m.

6th (Wed.). Meeting of the Midland Counties Division at the Regent Hotel, Leamington Spa, 2.30 p.m.

7th (Thurs.). General Meeting of the Central Veterinary Society at the Royal Veterinary College, Camden Town, N.W.1, 5.30 p.m.

14th (Thurs.). Annual Dinner and Dance of the Victoria Veterinary Benevolent Fund in the Northern Hotel, Aberdeen, 7.30 p.m.

18th (Mon.). 8th Annual Dinner of the University of Bristol Centaur Society at the Berkeley, Bristol.

29th (Fri.). Golden Jubilee Dance of the North of Ireland Veterinary Association at the Grand Central Hotel.

BRITISH VETERINARY ASSOCIATION QUARTERLY MEETINGS IN LONDON

Wednesday, November 13th, at No. 7, Mansfield Street.

10.30 a.m. Small-Animals Committee.
2.00 p.m. Parliamentary and Public Relations Committee.
4.00 p.m. Home Appointments Committee.

Thursday, November 14th, at No. 7 Mansfield Street.

10.00 a.m. Veterinary State Medicine Committee.
11.30 a.m. Farm Livestock Committee.
12 noon Finance Sub-Committee.
2.15 p.m. General Purposes and Finance Committee.

Friday, November 15th, at the Connaught Rooms—

10.30 a.m. Meeting of Council.

FOOT-AND-MOUTH DISEASE

The area described in the schedule below is declared to be an Infected Area for the purpose of preventing the spread of foot-and-mouth disease:—

The City and County Borough of Portsmouth.

IN THE COUNTY OF SOUTHAMPTON (HAMPSHIRE)
The Borough of Gosport.

The Petty Sessional Division of Fareham.
In the Petty Sessional Division of Droxford: The parishes of Curdridge, Shedfield and Swanmore and so much of the parishes of Denmead, Hambledon and Soberton as lies to the south and west of the road (B2150) running from Havant *via* Denmead to Droxford, excluding the said road.

ADDRESSES OF DISEASE INFECTED PREMISES

The list given below indicates, first the county in which are situated the premises on which disease has been confirmed, followed by the postal address and date of outbreak.

Anthrax

Ches. Church Farm, Wrenbury, Nantwich (Oct. 10).
Kincardine. Dykelands, Laurencekirk (Oct. 11).
Northumberland. Tuggal Grange Farm, Beadnell, Chathill (Oct. 8).
Pembroke. Robleston, Camrose (Oct. 11).
Yorks. The Farm, Tately Lana, Gawthorpe, Ossett (Oct. 9).

Fowl Pest

Kent. Oakdene, Bekesbourne, Canterbury (Oct. 12).
Lancs. Moss Poultry Farm, Longmeany Gate, Leyland, Preston (Oct. 7); Willow Brow, Moss Lane, New Longton, Preston; Stoneygate Allotments, Ribchester, Preston; Constablee, Mains Lane, Little Singleton, Blackpool; Stanleyfield, Long Moss Lane, New Longton, Preston; Valdene, Skip Lane, Hutton, Preston; Briads Farm, Chain House Lane, Whitestake, Preston (Oct. 8); Rangeover, Skip Lane, Hutton, Preston (Oct. 9); Goose Green Farm, Moss House Lane, Much Hoole, Preston; Todderstaffe Farm, Hardhorn, Blackpool; Briarfield, Gill Lane, Longton, Preston; Rosedale, Gill Lane, Longton, Preston; New Hall Farm, Wharles, Kirkham, Preston (Oct. 10); Nicky Nook, Brickfield Road, Croston, Preston; Greycott, Lytham Road, Warton, Preston (Oct. 12); Avondale, Station Road, Little

Hoole, Preston; 107, Slater Lane, Leyland, Preston (Oct. 13).

Lincs. Southfield House, Boston Road, Horncastle (Oct. 8); The Bungalow, West Ashby, Horncastle (Oct. 10).

Oxon. 8, Council Houses, School Lane, Stoke Row, Henley-on-Thames (Oct. 12).

Suffolk. Eye Road, Kenton, Stowmarket (Oct. 11).

Swine Fever

Berks. Henerton Court, Wargrave, Reading (Oct. 7).

Ches. Parkgate House, Saughall (Oct. 8).

Denbigh. Gwernhywel Bach, Ysptty Ifan (Sept. 30).

Derby. Redhill Farm, Hands Road, Heanor (Oct. 9); Highfield Farm, Ashby Road, Kegworth (Oct. 11).

Devon. Gladhayes Farm, Clayhidon, Cullompton (Oct. 9).

Dorset. Tripps Farm, Purse Caundle, Sherborne; Folly Farm, Purse Caundle, Sherborne (Oct. 9).

Flints. Cllwyd Pig Farm, Rhuddlan (Oct. 4).

Hants. Barnett End Farm, Barnetts Wood, Bighton (Oct. 3); Shalden Manor and Green Mount Farm Buildings, Shalden, Alton (Oct. 8).

Herts. Spring Farm, Theobalds Park, Enfield (Sept. 30.)

Leics. Manor Farm, Ullesthrope (Sept. 30); Moorbarns, Lutterworth, Rugby (Oct. 3); 65, Sapcote Road, Burbage; Long Acre, Ashfordby, Melton Mowbray (Oct. 7).

Norfolk. Botts Hill, Foulsham; Stadium Farm, Caistor on Sea (Sept. 30); Cross Roads Farm, Skeyton, Buxton, Norwich; Hill Farm, Westwick, Norwich (Oct. 3); Beck Hythe, Little Melton, Norwich (Oct. 4); 3, Council Houses, Church Lane, Wicklewood (Oct. 7); The Shop, Felmingham, North Walsham (Oct. 9).

Northants. Lodge Farm, Sutton Bassett, Market Harborough (Sept. 30).

Oxon. White House Farm, Watlington; Home Farm, Britwell Salome (Sept. 26).

Salop. Henneryon Court, Wargrave, Reading (Oct. 7).

Shrops. Stanlow Farm, Kingslow, Pattingham (Oct. 8); 7, Brades Road, Press, Whitchurch (Oct. 9).

Somerset. Greenaleigh Farm, Minehead (Oct. 27); Home Farm, Backwell House Estate, West Town, Bristol (Oct. 2).

Staffs. 36, Burntree, Tipton (Oct. 1); 11, Baker Street, West Bromwich (Oct. 2); Greensforge Farm, Swindon, Wolverhampton (Oct. 4); Streethouse Farm, Halfords Lane, West Bromwich (Oct. 10).

Surrey. Lingfield Lodge Farm, Marsh Green, Edenbridge (Sept. 26); Longview, Spring Lane, Upper Hale, Farnham (Sept. 27); Bulhousen Farm, Bisley, Woking (Oct. 7); Swimming Pool; West Hill, Epsom (Oct. 8).

Sussex. Piggeries at Ford Aerodrome, Ford, Arundel (Oct. 9th).

Wilts. 18/19, South Street, Warminster (Sept. 30).

Worcs. Roadside, Brockhill, Norton; Alkaline Batteries Allotment, Union St., Redditch (Oct. 2).

Yorks. Highstone Smallholding, Worsborough Common, Barnsley (Oct 4); Manor Farm, Wadsworth, Doncaster (Oct. 7).

CORRESPONDENCE

The views expressed in letters addressed to the Editor represent the personal opinions of the writer only and their publication does not imply endorsement by the B.V.A.

The " Rights " of Animals

Sir,—Of your three correspondents, Major Wilkins has taken us farthest into the deeps of opinion versus authority and science versus reason. In my earlier letter (as also again now) I tried to give a résumé of the opinions of Christian thinkers on the subject, which on examination appeared to me authoritative.

Philosophy (φιλία τῆς σοφία) has been well defined as the science of reality in terms of ultimate causes gained by the light of natural reason. I imagine this to be acceptable to Major Wilkins as a veterinary scientist. " Ultimate " is included to indicate that the conclusions reached by philosophers in their investigation of reality should be final and not provisional. Wisdom (σοφια) demands a definitive solution of the problems of experienced reality—a philosopher should not be content with suggestions as to how things may have been caused or about possible ends for which they may conceivably exist; rather he needs to know the actual causes, both final and efficient, which explain adequately the universe in which he lives. For a philosopher, then, the supernatural constitutes something of a problem, partly because it involves the presence in reality of elements he can never come to know by unaided reason, and partly because it makes his explanations of the reality he does know, to some extent provisional. To say that his explanations are provisional does not of course imply that they may turn out to be wrong since there cannot be " two truths," but it does mean that the philosophical explanation of reality is essentially (*i.e.* in its essence) imperfect—a partial explanation of truth. Thus Major Wilkins does have some degree of justification in saying " sophist " to me.

For a Christian, in consequence, philosophy is the search for an essentially imperfect understanding of reality and the question naturally arises as to how this can be made a search for wisdom in the sense of its being a completely satisfying and universal understanding of reality. Distinctions can of course be made. It can be said that philosophical understanding is satisfactory at the level of human reason, that it enables us to understand nature to the extent to which nature is intrinsically intelligible that it constitutes the " whole truth " within natural limits. On the other hand the supernatural is above the natural, and knowledge of it or ignorance does not intrinsically affect our knowledge of the natural universe.

This kind of distinction leads to a fairly clear-cut distinction between the natural and the supernatural and a consequent distinction of philosophy from theology. It has, however, one practical drawback since its acceptance can lead to the view of reality as a collection of natures complete in themselves to which the supernatural has been added as a kind of metaphysical accident, and for which, in the natures themselves, there exists no natural potentiality.

Without some potentiality in nature for the supernatural there can of course be no real continuity, and to avoid this difficulty " obediential potentiality " is invoked (*cf.* as parallel the Aristotelian theory of the surgence of the animal soul from the potentiality of matter and its return thereto on death). As far as can be seen, this kind of potentiality is a capacity but not a tendency, a negation but not a privation. It has reference to a cause of infinite power which is creative, not merely " eductive." The same distinction applied to natural and supernatural truth would seem to imply that philosophical understanding is capable of being perfected by revealed wisdom, but has no natural demand or tendency to such perfecting. Since wisdom as knowledge is essentially conscious this might lead to the view that there can be no conscious articulation of natural with supernatural truth.

On the other hand, if some such distinction is not made, it is almost inevitable that philosophy will either merge with or conflict with revealed truth. Conflict will take place if philosophical understanding lays claim to universality and adequateness—the supra-reasonable will be rejected as the unreasonable. I concede Major Wilkins is interpretatively right up to this point, but merging will take place where revealed truth is accepted as unique wisdom, and philosophy will appear as an unsatisfying alternative to divine wisdom.

I believe, Sir, that the Christian in philosophy is a Christian man trying to see life steadily and whole, seeking a comprehensive vision of all the facts, natural, aesthetic, moral, and social, by interpreting them as the constituents of a Christian universe, best, because most profoundly, comprehensively and stimulating, explained in terms of analogies drawn from the experience of Christian personality in Christian history. The function of the Christian philosopher is not primarily apologetic at all. He is not in any sense an organ of an evangelical church, but a philosopher seeking to interpret life and reality. His aim is to proclaim and illustrate the truth as he sees it.

Yours faithfully,
HUGH THORNTON.

The Farmers Club,
3, Whitehall Court,
London, S.W.1.

October 10th, 1957.

Sir,—One who has had the opportunity to study the massive works of Aquinas, from the early *Commentary on the Sentences* to the uncompleted *Summa Theologica*, might well hesitate to pontificate on the author's views on the status of animals. However, the theological tradition of which Aquinas is the most distinguished source is easier of appraisal; and the following judgments would, I think, find universal acceptance.

Firstly: even if the animals have no rights, their Creator has; and any abuse of the animal creation is therefore an offence against God. Secondly: obligations can arise (and with them at least quasi-rights) from charity as well as from justice. Charity is all-embracing; and includes the animal as well as the human creation. Thirdly: cruelty is a sin against the person who commits it, even if it cannot be regarded as a sin against the animal thus abused.

The humane treatment of animals is therefore incumbent on Roman Catholics, irrespective of any theological argument as to the existence or otherwise of "rights" in animals. It is also quite clear from St. Paul that the animals are part of the creation which is to be redeemed; and it follows that improvement in their status will be the mark of a Christian civilisation. The present Pope has given a lead in the development of a humane attitude towards the animals; and the animal-welfare movement has distinguished patronage amongst the Roman Catholic hierarchy in this country.

At an animal-welfare service held the other week at Salisbury Cathedral, the burden of the address, given by a Canon of the Cathedral, was that there is no need to deny immortality to the animals. It would thus seem that, though the detailed working out of the doctrine has not yet been achieved, there are ample grounds in Christian theology for the views of that other great mendicant Saint of the 13th century—St. Francis of Assisi—who did not hesitate to refer to the animals as his brothers and sisters.

Yours faithfully,
PETER D. TURNER.

Cave Cottage,
Oakridge Lynch,
Stroud,
Glos.

October 13th, 1957.

Sir,—Mr. Gledhill takes me to task for writing "animals have the same rights as we have." I stand firmly by my statement. Man, mouse, and mosquito, all come into this world willy-nilly, never of their own choice. None come by divine selection but on account of reproductive processes basically alike—perhaps a little more advanced in the case of the mosquito.

Once here, all three set about making the best of things as they find them, in accordance with their inherent capabilities and their evolutionary adaptation. The killing of the weaker by the stronger can be excused only on the score of self-preservation. The lion kills because it is hungry, never for pleasure.

To mutilate, or inflict suffering which is avoidable, ranks as sadism; deliberate cruelty is practised only by those of an order of intelligence sufficiently advanced to find vicious delight in its implications. Might can never be right, either in principle or practice, and if man were blessed with half the intelligence with which he credits himself he would realise that it is his privilege to help and protect the weak, guided not by sentiment but by humanity and a God-given ability to determine what is right and what is wrong.

Unhappily, being the world's greatest contradiction as well as its supreme egoist, he finds it quite consistent to preach, "Do unto others," shoot or mutilate a score of helpless birds and revel in the closing stages of a stag-hunt—all in one glorious day. Who are those "others"? Should a Christian philosopher include among them the "lower" creatures, or only the various human races which inhabit the earth? Looking around it to-day, one wonders.

Yours faithfully,
R. H. SMYTHE.

6, Peveril Drive,
The Park,
Nottingham.

October 12th, 1957.

Sir,—Mr. Edwards is correct in stating that according to Catholic theology no unbaptised person can enter the kingdom of heaven. However, no man's

life ends at death, unlike the life of an animal which certainly does.

Dogma is not obscurantist. It has been compared more accurately by Chesterton to a flash of lightning which illuminates a whole landscape. Let the Prince of Denmark answer Mr. Smythe. "What a piece of work is man! how noble in reason! how infinite in faculty! in form and moving how express and admirable! in action how like an angel! in apprehension how like a god! the beauty of the world! the paragon of animals."

We are the crowning glory of Creation (or evolution), not just a nasty accident.

Yours faithfully,
A. L. BONGARD.

5, Ann Street,
Enniskillen,
Co. Fermanagh.
October 14th, 1957.

Rubarth's Disease

Sir,—In his contribution to the In Brief series entitled "Rubarth's Disease—HCC" published in your issue of October 12th, Dr. W. Mansi states that, "A complement fixation test for the differentiation of the disease from the canine distemper complex was reported by Mansi (1955)." With due respect to Dr. Mansi, I would point out that while his statement is undoubtedly true, it may be misleading. In fact, the complement fixation test for the differentiation of canine hepatitis virus from canine distemper virus was first described by Rubarth (1947). Four years later, it was found that the complement fixing antigen specifically related to the particle of canine hepatitis virus (Larin, 1951).

From 1951 to 1955 we assisted veterinary surgeons in practice, by carrying out some thousands of the complement fixation tests. A survey of the various current principles and procedures for the diagnosis of canine virus hepatitis was published in your pages in 1953 (Hodgman & Larin, 1953).

Yours faithfully,
N. M. LARIN.

Canine Health Centre of the Animal Health Trust,
Kennett,
Newmarket.
Suffolk.

October 14th, 1957.

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Should We Investigate "The Box"?

Sir,—Like many other practitioners I have, during recent years, heard of the "miraculous" cures effected by "the Box," almost invariably involving hunters and Thoroughbred horses. Again, like the majority of practitioners, my information has always been second- or third-hand and never a case of which I have first-hand knowledge.

I do agree with others who have written to THE RECORD that "the Box" should be investigated and a report published. There are, as far as I am aware, only two "Boxes" in operation, one in Oxford and the other in London.

In 1954 I had the opportunity of inspecting and, to a certain degree, testing "the Box." I met the two people who operate this instrument and a technician. I was informed that diagnosis and treatment can be effected if a spot of blood on a piece of blotting paper or hairs taken from a patient can be supplied. This sample is placed in one end of the equipment which is a large black box (from memory I would say a 4-ft. cube). Dials on the other three sides are then adjusted and, as far as I remember, it is from the readings thus gained that a diagnosis is made. In addition, from the box can be produced a photograph purporting to be that of the affected organ. I was shown a number of photographs of human origin in which I could recognise anatomical structures. I regret, however, that the photographs produced from the samples that I submitted were, to me, quite unintelligible.

In a room downstairs there were shelves on which were arranged a number of small, black boxes, approximately 12-in. cube, with something resembling a small aerial protruding from the top. These, I was informed, were the "Treatment Boxes." In some instances during treatment a crucible containing a small quantity of various drugs is placed on top of these boxes and they are switched on at a set time each day, generally, I believe, about 10 a.m.

For diagnostic purposes I submitted blood samples from cats and bitches to be examined for pregnancy. About 50 per cent. were correct. Various other samples were given for diagnostic purposes and the following is a report on a greyhound which was suffering severely from cramp when racing:—

RADIONIC ANALYSIS

"NOBLE BLONDE" SUFFERING FROM CRAMP

Main parts affected are: respiratory system, nervous system, urinary system, and muscular system. In these parts are the vagus nerve of the lungs, the pons, cranial nerves, ureters, ligaments of the bladder, and muscle cells.

These parts are affected by toxins, muscular strain, spasm and rheumatism, and are being treated accordingly.

This is a radionic analysis and must not be interpreted by medical terminology.

You will notice the last paragraphs of this report, and this is a point which I took up very strongly, namely that their analysis must not be interpreted by medical terminology. I suggested that if this were so, then they should invent a terminology of their own and not use medical terms if they do not intend them to be interpreted as such.

Yours faithfully,
A. H. ROBB.

16, Ward Street,
Glasgow.

October 15th, 1957.